IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
UTILITY PATENT APPLICATION TRANSMITTAL LETTER

Attorney Docket No.: GE04442

Mailing Date: July 1, 1998

To: Assistant Commissioner for Patents
Box Patent Application
Washington D.C., 20231

Dear Sir:

Transmitted herewith for filing under 37 C.F.R. 1.53(b) is a Nonprovisional Utility Patent:

☒ New Application; or

☐ Continuation; or ☐ Divisional; or ☐ Continuation-In-Part (CIP); of prior US Application No. _____, filed on _____, having U.S. Examiner _____, in Group Art Unit _____

Of: Lanny Joe Mullens, David Wallis, Gail Miyamoto, and Michael Kronick

For: **METHOD FOR RF NETWORK VIRTUAL END NODES**

☒ 2 sheets of drawings and 14 pages of specification and claims.

☒ Newly executed oath or declaration combined with Power of Attorney on 2 pages.

☐ Copy of oath or declaration from prior U.S. application serial no. _____
☐ The following named inventor(s) from the prior application are hereby deleted from this application in accordance with 37 C.F.R. 1.63(d)(2) and 1.33(b): _____.

☐ A certified copy of a _____ (non-US) application serial number _____, having a filing date of _____, and foreign priority to this non-US application for the present application is hereby claimed under 35 USC 119.

☒ An Assignment Transmittal Letter and Assignment of the invention to Motorola, Inc.

☐ An Information Disclosure Statement (IDS), with PTO-1449, and _____ citation copies.

☒ Return Receipt Postcard.

☐ Preliminary Amendment.

☐ Please cancel pending claims _____.

☐ Incorporation by Reference (for Continuation/Division/CIP application). The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied, is considered as being part of the disclosure of the accompanying application and is hereby

incorporated by reference therein. Since the present application is based on a prior US application, please amend the specification by adding the following sentence before the first sentence of the specification:

"The present application is based on prior US application No. _____, filed on _____, which is hereby incorporated by reference, and priority thereto for common subject matter is hereby claimed."

☐ Applicant hereby petitions pursuant to 37 C.F.R. §1.136(a) for a _____ month extension of time for response to the outstanding Official Action mailed _____. The period for response was previously set to elapse _____, and is accordingly hereby extended to _____, which is still within the six-month statutory period for response (35 U.S.C. § 133) which elapses _____. The reason for this petition is that a Division or Continuation CPA is being filed, and it is desired to maintain the present application in pending condition pursuant to 35 USC § 120 through at least the filing of the Division or Continuation CPA application. The required Extension Fee established by 37 C.F.R. § 1.17(a) pursuant to 35 U.S.C. § 41(a) (8) is:

EXTENSION	FEE
☐ First Month	$110.00
☐ Second Month	$400.00
☐ Third Month	$950.00
☐ Fourth Month	$1,510.00
☐ Fifth Month	$2,060.00

☒ The filing fee is calculated as follows:

CLAIMS AS FILED, LESS ANY CANCELED BY AMENDMENT

FOR	NUMBER OF CLAIMS	NUMBER EXTRA	RATE	FEE
TOTAL CLAIMS	20 - 20 =	0	x $22	= $ 0.00
INDEPENDENT CLAIMS	3 - 3 =	0	x $82	= $ 0.00
MULTIPLE DEPENDENT CLAIMS			$270	= $ 0.00
BASIC FEE				= $ 790.00
TOTAL FILING FEE				= $ 790.00

☒ Please charge Deposit Account No. 13-4771 in the amount of $ 790.00 for the Total Filing Fee, and the Extension Fee under 37 C.F.R. §1.136(a), if applicable.

☒ The Commissioner is hereby authorized to charge any additional fees which may be required now or in the future during the entire pendency of this application under 37 C.F.R. 1.16 or 37 C.F.R. 1.17, including any present or future time extension fees which may be required, or credit any overpayment to Deposit Account No. 13-4771.

☒ This sheet is submitted in triplicate.

This transmittal letter has 3 total pages.

7/1/98
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METHOD FOR RF NETWORK VIRTUAL END NODES

Background of the Invention

The present invention pertains to RF (radio frequency) networks and more particularly to an arrangement for supporting virtual end nodes in an RF network.

In an RF network where end nodes communicate with access points via wireless communications, data packets are typically sent to the end node by means of a specific address associated with each end node. The access point is the network device which communicates directly with end nodes (users). A data packet typically includes, at the beginning, the routing information. The routing information includes the MAC address of the next hop on the network and the IP (internet protocol) address of the ultimate destination end node.

In such a system, the internet protocol addresses of the access point and end nodes must be registered in the routing tables in each of the RF repeaters and access points in order for messages to travel between end nodes. As a result, the number of end nodes users permitted to an access point was fixed depending on the size of the address fields within the normal internet protocol packet. Thus, if more end node users were to be added, more access points were required up to the limit of the fields in the internet protocol defining the addresses of the access points. Adding access points requires further processing by the RF network, takes up space for additional hardware and is costly.

Accordingly, it would be advantageous to provide an arrangement for extending the number of end node users connectable to an RF network while keeping the amount of added hardware and associated floor space required to a

minimum. Further, such system should provide for a cost efficient way in which to add further end node users.

Brief Description of the Drawings

FIG. 1 is a block diagram of a virtual RF network for supporting extended end node users in accordance with the present invention.

FIG. 2 is a layout of an internet protocol for routing of packets to virtual RF end node users in accordance with the present invention.

FIG. 3 is a flow chart of a method for virtual end nodes in accordance with the present invention.

Description of the Preferred Embodiment

FIG. 1 depicts a conventional RF internet system including standard end nodes and virtual end nodes. Host system 10 attempts to communicate with end node devices 21-43. End node devices 21 and 22 are standard RF end node devices. The RF internet is organized so that access points communicate via RF links to end nodes.

To communicate via the RF internet, host system 10, for example, transmits via a wired connection 13 to a root access point 11. The information transmitted by host system 10 may be buffered and is re-transmitted by root access point 11. Root access point 11 determines which lower level access point is to receive the message intended for an end node by looking at its routing tables. Root access point 11 tables the message through access points 12, 14 or 16, for example. Root access point 11 transmits via an RF link the message packet intended for a particular end node through access point 12, 14 or 16.

In the typical RF internet system, access point 12 then determines that the normal internet protocol (IP) routing information includes an address of either end node 21 or end node 22. As a result, access point 12 then via an RF link 17 transmits the data packet. All end nodes read the data packet and only the one addressed processes the user data and responds. The data portion of the normal internet protocol packet is then handled typically by the individual end node, 21 or 22 in this case.

The amount of data comprising the routing information is limited for this case of the normal internet protocol. As more and more end nodes are to be interconnected to the RF internet, the number that may be connected to a particular access point is limited by the size of the address fields in the normal internet protocol routing information. See FIG. 2. The result is that more access points must be added to add more end nodes. A method to add more end nodes for a given access point would greatly increase the system capacity and decrease the number of access points required for the system. In addition to being cost effective, having less access points in the system would take up less real estate and floor space in a distributed network approach. Both are highly desirable goals.

Referring to FIG. 2, an RF packet in the RF internet is shown with modifications in accordance with the present invention. The data packet 50 includes a normal internet protocol routing information 51 and user data 54. The normal or traditional internet protocol data packet includes the identity of the recipient 56 and the identity of the original source 55. The present invention, in part, places the identity of a physical end node into a field 52 and the remaining user data 53 in data packet 54.

Each access point in the RF system has an internet protocol address. This internet protocol address is included within the normal internet protocol routing information 51.

Referring again to FIG. 1, each access point 12, 14 and 16 and root access point 11 implements full internet protocol addressing. Although only one root access point 11 and three access points 12, 14 and 16 are shown, there may be many of these associated with the system and may be several levels of root access points. Also, within the normal IP routing information 51 is the identity of the intended end node included in field 56. In this way, the access points 12, 14 and 16 or host system 10 or root access point 11 may know the identity of the particular end node in its group to receive the message.

In the present invention, destination MAC address 52 and destination IP address 56 for the last hop from the access point are for the virtual node device. Since each access point 12, 14 and 16 has the routing information for its virtual end nodes, they can transmit to these devices. This routing information contains the MAC and IP addresses for the virtual end nodes. Each physical end node in the groups examines the extended identity field 52 to determine whether it is the data package target. The particular target physical end node 42, for example, will process the data and respond. Nodes 41 and 43 will not respond to the data packet because their identity does not match the address in field 52.

For example, should access point 14 receive a data packet indicating in the normal internet protocol routing information 51 that the recipient is a virtual and node device (33) which it has in its routing table, the access point 14 then transmits the data package to its physical end nodes 31 and 32. The physical end node identification 52

will be examined by all nodes 31 and 32 and the node addressed in field 52 will process the user data 53 and respond to the network.

Similarly, access point 16 may transmit data packets to virtual end 44 which has the effect of transmitting to physical end nodes 41, 42 or 43 via RF link 19. If the identity of physical end node 41 is indicated in field 52, node 41 will process the data, but all nodes 41-43 will read the data packet to determine whether the packet is for them.

As can be seen, the effect of adding field 52 adds the ability to address many physical end nodes using a single MAC an IP address pairs. Also, this scheme has the benefit that it does not disturb the field termed the normal internet protocol routing information 51. This is extremely important since this field has been standardized for use on the internet.

Referring to FIG. 3, a flow chart of a method for virtual end nodes in an RF network is shown. The method is started and block 60 is entered. The IP address of the destination virtual end node is inserted in field 56 and the identification of the physical end node is inserted in 52.

Using the normal internet routing tables, the destination MAC address for the next hop is inserted into field 57. The packet is transmitted. The packet is then routed from hop to hop using normal internet routing protocol until it is transmitted for the last hop from the access point over the RF link.

At each hop along the way normal routing tables are used to determine the next hop. For the final hop from the access point to the virtual end node device, this is also true. The receiving physical end node devices receiving the RF packet decode the data field to find the destination IP in field 52. They compare this with their own ID. If there

is a match, they accept the packet and process it, otherwise they ignore it.

As can be seen from the above explanation, a number of physical end nodes may be added to the capability of any access point in a network. The only limitation of this method is the number of bits that may be used within the user data to indicate the identity of various physical end nodes.

Although the preferred embodiment of the invention has been illustrated, and that form described in detail, it will be readily apparent to those skilled in the art that various modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

CLAIMS

What is claimed is:

1. A method for virtual end nodes in an RF network using a data packet including a first field, a second field and user data, the method for RF network virtual end nodes comprising the steps of:

inserting in the first field a first virtual identity of an access point which communicates with a virtual end node;

inserting in the second field a second virtual identity of the access point;

inserting in the user data an address of a physical end node corresponding to a virtual end node;

transmitting said data packet through said RF network to the access point;

broadcasting the data packet by the access point; and

determining by the physical end node whether the data packet is directed to the physical end node.

2. The method as claimed in claim 1, wherein there is further included a step of determining whether a contents of the first field corresponds to the first virtual identity.

3. The method as claimed in claim 2, wherein there is further included a step on determining whether a contents of the second field corresponds to the second virtual identity.

4. The method as claimed in claim 3, wherein there is further included by the access point a step of determining whether the data packet is for the virtual end node.

5. The method as claimed in claim 1, wherein:

the step of inserting in the first field is performed by a host system;

the step of inserting in the second field is performed by the host system; and

the step of inserting in the user data is performed by the host system.

6. The method as claimed in claim 1, wherein:

the step of inserting in the first field is performed by an end node;

the step of inserting in the second field is performed by an end node; and

the step of inserting in the user data is performed by the end node.

7. The method as claimed in claim 1, wherein:

the step of inserting in the first field is performed by an access point;

the step of inserting in the second field is performed by an access point; and

the step of inserting in the user data is performed by the access point.

8. The method as claimed in claim 1, wherein:

the step of inserting in the first field is performed by the virtual end node;

the step of inserting in the second field is performed by the virtual end note; and

the step of inserting in the user data is performed by the virtual end node.

9. The method as claimed in claim 1, wherein there is further included the steps of:

determining by an access point whether the first virtual identity is in the first field and

determining by an access point whether the second virtual identity is inserted in the second field.

10. A method for expanding a number of physical end nodes in an RF network, the method using a data packet including routing information and user data, the method for expanding the number of physical end nodes in an RF network comprising the steps of:

adding a physical end node with a virtual address;

indicating within the routing information that the physical end node with the virtual address is to receive the user data;

inserting an identity of the physical end node with the virtual address within the user data;

transmitting the routing information along with the user data through the RF network; and

determining by the physical end node with the virtual address whether the physical end node is to receive the user data.

11. The method as claimed in claim 10, wherein there is further included a step of obtaining by the physical end node the identity of the physical end node with the virtual address.

12. The method as claimed in claim 10, wherein there is further included a step of determining by the RF network that the user data is to be transmitted to a physical end node with the virtual address.

13. The method as claimed in claim 12, wherein there is further included a step of transmitting user data to the physical end node with the virtual address.

14. The method as claimed in claim 10, wherein the step of indicating includes the step of setting a first field of the routing information equal to a second field of the routing information.

15. The method as claimed in claim 14, wherein there is further included a step of processing by the physical end node with the virtual address the user data with the virtual address.

16. The method as claimed in claim 10, wherein the step of inserting is performed by a host system.

17. The method as claimed in claim 10, wherein the step of inserting is performed by an access point.

18. The method as claimed in claim 10 , wherein the step of inserting is performed by an end node.

19. The method as claimed in claim 10, wherein the step of inserting is performed by the physical end node with the virtual address.

20. A method for expanding a number of end nodes in a network, the method using a data packet including routing information and user data, the method for expanding the number of end nodes in a network comprising the steps of:

adding an end node with a virtual address;

indicating within the routing information that the end node with a virtual address is to receive the user data;

inserting an identity of the end node with a virtual address within the user data;

transmitting the routing information along with the user data through the network; and

determining by each of the end nodes the identity of the end node with a virtual address to receive the user data.

METHOD FOR RF NETWORK VIRTUAL END NODES

Abstract of the Disclosure

A method for virtual end nodes indicates in routing information (51) that the data packet is for a "special access" to an end node with a virtual address (60). An RF network device then inserts the identity of the physical end node (virtual address) into user information (62). If an access point (14) determines that the user information is for the virtual address (66), then all virtual end nodes 41-43 receive the data packet and analyze the virtual end node identity from the user information (68).

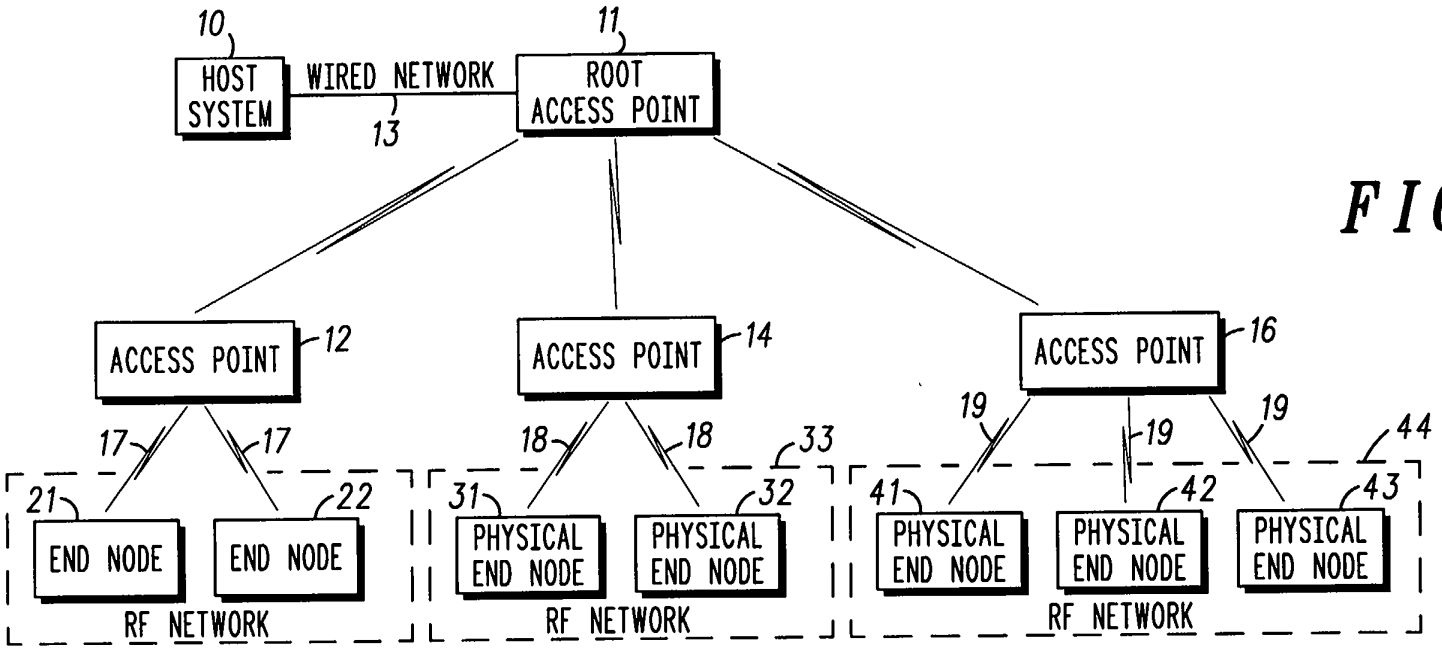
10
HOST SYSTEM
WIRED NETWORK
13
11
ROOT ACCESS POINT
ACCESS POINT
12
ACCESS POINT
14
ACCESS POINT
16
17
17
18
18
33
19
19
19
44
21
22
31
32
41
42
43
END NODE
END NODE
PHYSICAL END NODE
PHYSICAL END NODE
PHYSICAL END NODE
PHYSICAL END NODE
PHYSICAL END NODE
RF NETWORK
RF NETWORK
RF NETWORK

FIG. 1

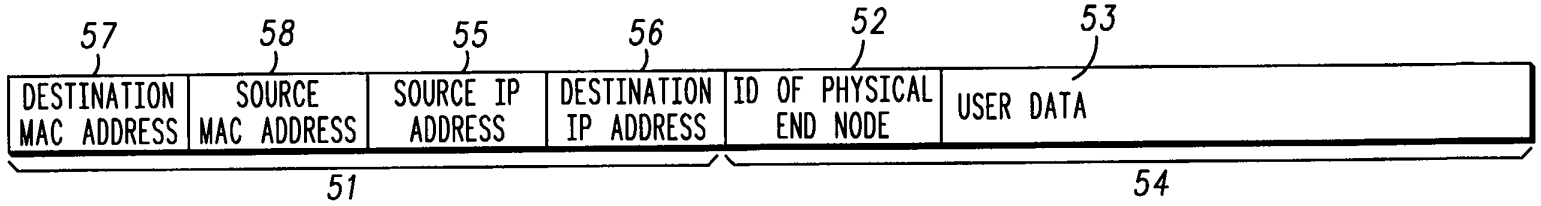
57
58
55
56
52
53
DESTINATION MAC ADDRESS
SOURCE MAC ADDRESS
SOURCE IP ADDRESS
DESTINATION IP ADDRESS
ID OF PHYSICAL END NODE
USER DATA
51
54

FIG. 2 50

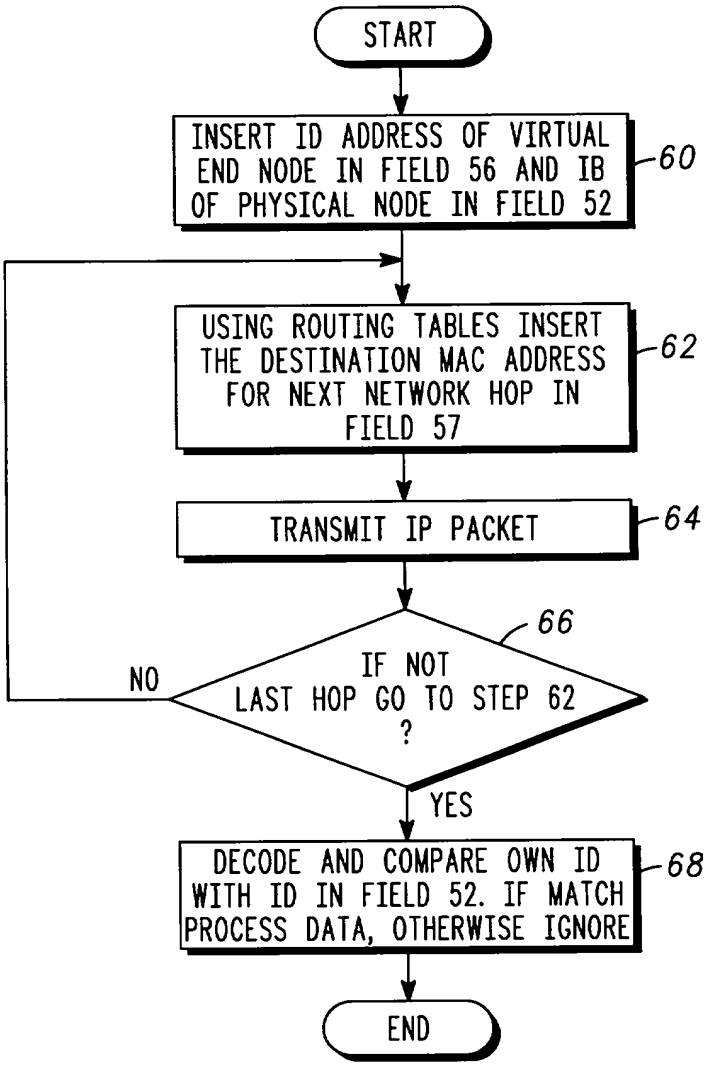
START
INSERT ID ADDRESS OF VIRTUAL END NODE IN FIELD 56 AND IB OF PHYSICAL NODE IN FIELD 52
60
USING ROUTING TABLES INSERT THE DESTINATION MAC ADDRESS FOR NEXT NETWORK HOP IN FIELD 57
62
TRANSMIT IP PACKET
64
66
IF NOT LAST HOP GO TO STEP 62 ?
NO
YES
DECODE AND COMPARE OWN ID WITH ID IN FIELD 52. IF MATCH PROCESS DATA, OTHERWISE IGNORE
68
END

FIG. 3

COMBINED DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

Attorney Docket GE04142

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below), or an original, first and joint inventor (if plural names are listed below), of the subject matter which is claimed and for which a patent is sought on the invention entitled METHOD FOR RF NETWORK VIRTUAL END NODES, the specification of which is attached hereto unless the following box is checked:

☐ Application was filed on _____
as Application No. _____
and was amended on _____.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)			Priority Claimed
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	☐ Yes ☐ No
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	☐ Yes ☐ No

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below.

_____ (Application Number)	_____ (Filing Date)
_____ (Application Number)	_____ (Filing Date)

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose

information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

(Application Number)	(Filing Date)	(Status - patented, pending, abandoned)
(Application Number)	(Filing Date)	(Status - patented, pending, abandoned)

I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

Maurice J. Jones, Reg. No. 25,991; Frank J. Bogacz, Reg. No. 29,047; Bradley J. Botsch, Sr., Reg. No. 34,552; Gregory J. Gorrie, Reg. No. 36,530; Walter W. Nielsen, Reg. No. 25,539; Harold Clayton McGurk IV, Reg. No. 34,964; Sherry Jeanne Whitney, Reg. No. 39,422; Dana B. LeMoine, Reg. No.40,062; Jennifer B. Wuamett, Reg. No.40,878; John C. Scott, Reg. No. 38,613.

Address all telephone calls to Mr. Frank J. Bogacz at telephone no. (602) 441-4301.

Address all correspondence to Maurice J. Jones, Motorola, Inc., Intellectual Property Department - Suite R3108, P.O. Box 10219, Scottsdale, AZ 85271-0219.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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